a mere introduction. But these results can be secured only by earnest, skilful, continuous experimental investigation, which is practically impossible without pecuniary support. In France and Germany such support is liberally supplied by the government; in the United States, where human life is certainly as valuable as there; where live-stock interests are already greater than in these countries combined, and must multiply many fold in the immediate future; where a single infectious disease of cattle has caused the loss of $20,000,000 in one year, and a single disease of hogs the destruction of $30,000,000 in the same time; where infectious diseases are so prevalent among live stock that the fear of infection has closed European markets against American meat and cattle — the government of this great commonwealth, which advances enormous sums for local river and harbor improvements; which sends expensive commissions over the world to observe the transit of Venus or of the moon, or to find an open polar sea; and engages in other undertakings of purely scientific interest, has not yet made one judicious, systematic, liberally supported inquiry into the possibility of acquiring protection against pleuro-pneumonia, hog-cholera, and other devourers of the national wealth. A glance at the imperial German health bureau and its work during the last four years, and a mental comparison of the pecuniary resources of Germany with those of the United States, inspire the hope that we shall not always lag so far behind in matters which appeal to the tenderest spot of the American anatomy — the pocket."

Dr. Gradle's book is made up of eight lectures delivered in Chicago, and is published on a more ambitious scale than are those of Dr. Belfield. For the beginner, or for one who is neither a pathologist, biologist, nor physiologist, this book is the more suitable. Its style is diffuse — not always, however, with a gain in perspicuity; and its index, its references to authorities, and its evident intention to give to all sides a fair showing, are features to be specially commended.

In these lectures we have, in fact, rather the report of the evidence than the judge's charge to the jury. We miss that critical and even judicial flavor which is so pleasant a feature of Dr. Belfield's book; and on that account we must consider the latter more suitable for the connoisseur; the former (Dr. Gradle's), for the beginner or the casual reader.

INTELLIGENCE FROM AMERICAN SCIENTIFIC STATIONS.

GOVERNMENT ORGANIZATIONS.

Geological survey.

Yellowstone national park. — During the season of 1883 Mr. Arnold Hague began work in the Yellowstone national park, preliminary to a series of careful and systematic observations which are to be prosecuted in this field through a number of years. The geysers are to be made the subject of minute study; and the volcanic rocks, so abundant at numerous points in the park, will be examined in detail, not only as regards their geologic relations, but also in regard to their structure and composition. The field investigations in the park during the past season were confined mainly to the preliminary examinations necessary to determine what geologic and physical problems have to be solved, and to ascertain what thermal changes had taken place since the observations of 1878 recorded by Dr. Peale. Mr. Hague's party was constituted as follows: Mr. Arnold Hague, geologist in charge; Messrs. Joseph P. Iddings, W. H. Weed, George M. Wright, and C. D. Davis, assistant geologists; Dr. William Hallock, physicist; Mr. W. H. Jackson, photographer, with an assistant; Mr. Roland Holt, volunteer assistant; and cook, packers, etc.

Geologic work. — Mr. Hague took the field the latter part of July, outfitting at Bozeman, Montana. Work was begun in the park at Mammoth hot-springs early in August. From this point, slow marches were made to the upper geyser basin of Fire Hole River, to allow of a geologic reconnaissance of the route followed. At the latter locality a permanent camp was established until the last of August. In the mean time a hurried trip was taken to the Shoshone geyser basin and the Heart-lake basin, for the purpose of comparing them with the geyser basins of the Fire Hole River, and to note what changes have occurred during the past five years. While on this trip, Mount Sheridan was ascended. Mr. Hague thinks that this mountain, from which a fine view of the surrounding country was obtained, is a volcanic crater, which has been so greatly modified by glacial action that its true origin has been obscured.

Camp was moved from the geyser basin to the Great Falls of the Yellowstone, Sept. 1, and kept there until the 19th. While at this point, the structure of the Mount Washburn was examined, and a trip made to the head waters of the Gardiner and Gibbon Rivers. The region of the Grand Cañon was also investigated, and the bottom reached at four different places. The Grand Cañon is an admirable place to study the decomposition of rhyolitic flows, the weathering of which has produced the brilliant coloring for which the cañon is so justly celebrated. A trip was also made from this camp to Steamboat Point, on Yellowstone Lake, from which point the ascent of Mount Chittenden was made. Mr. Hague considers this mountain one of the best points of observation within the limits of the park, and, after a trail has been built to it, thinks it will become one of the objective points of tourists who visit the lake. It surpasses Mount Washburn; as it gives a closer and more detailed view of the lake, and presents a magnificent panorama of the high mountain range on the east side of the park. The prospect is perhaps not so ex-

tensive as that seen from the summit of Mount Sheridan, but it is superior to it from the fact that the objects one wishes to see are nearer at hand. On the eastern slopes of the mountain is a remarkably fine glacial cañon.

From the Yellowstone Falls, camp was moved once more to the geyser basins, whence a trip was made to the western limits of the park, *viâ* the Madison plateau, returning through the Madison cañon, which exposes a fine section of the rhyolitic rocks that form the plateau.

The latter part of September camp was again established at the Mammoth hot-springs. The weather throughout the month had, with the exception of a few days in the latter part, been exceptionally fine for field-work; but October was ushered in with a severe snow-storm. Notwithstanding the inclemency of the weather, Messrs. Iddings and Wright undertook a reconnaissance of the region north of Mount Holmes, on the west side of the park, with a view to obtaining more accurate information as to the granitic area that lies just east of the rhyolitic flows that form the plateau of the park. The results, however, were meagre, on account of the severity of the storms and the depth of the snow.

At the same time Mr. Hague, accompanied by Mr. Weed, crossed the park in the opposite direction, to the head waters of Soda Butte Creek, with two objects in view, — 1°, to make a rapid geological reconnaissance across the northern part of the park to obtain definite personal knowledge of the Yellowstone Range; and, 2°, to visit the Clarke's Fork mines in order to learn their position in relation to the park boundaries, and to ascertain the extent to which mining operations have been pushed, and also to form an opinion as to the future prospects of the district as a mining-centre. The trip was a valuable one for general geologic purposes, and as suggesting plans for future operations, but for detailed work was not perfectly satisfactory, as the country was covered with snow, and snow-storms were of daily occurrence.

Although work was continued for some time longer in the vicinity of the Mammoth hot-springs, the weather remained so stormy that it was decided to pack the collections and leave the field; which was done the latter part of October, when the members of the party returned to the east.

Physical researches. — The geysers of the park suggest a number of physical questions which can be solved only after a complete and careful investigation, opportunities for which are nowhere presented with greater facilities than within the limits of the Yellowstone national park. The study of these questions was assigned to Dr. William Hallock, who steadily carried forward his observations in the Fire Hole geyser basins during August and September, and, since his return from the field, has been conducting a series of experiments in the laboratory at New Haven. When the results of these studies and experiments shall be made public, it will be seen that they are of the utmost scientific value.

Photographic work. — Mr. William H. Jackson, so well known from his photographic work in the park, while connected with Dr. Hayden's survey of the territories, accompanied Mr. Hague's party, and had a most successful season. His series of instantaneous views of the geysers in action will prove of great interest.

He obtained a large view (sixteen by twenty-two inches) of the lower falls of the Yellowstone, from a point at the bottom of the Grand Cañon just below where the water reaches the cañon, after its descent of more than three hundred feet. He also secured a fine large panoramic view from the summit of Mount Washburn.

A number of views of Yellowstone Lake were taken, that are particularly good.

Topographic work. — In order that the detailed geologic structure of the park may be correctly delineated, it was decided to begin topographic work for a detailed map, especially as the survey of the western and north-western portions of the park had never been completed. This work was intrusted to Mr. J. H. Renshawe, who undertook plane-table work on a scale of two inches to the mile. He outfitted his party at Bozeman, Montana, and began work in August in the West Gallatin Range, — a beautiful and interesting group of mountains, seldom or never visited by tourists, lying in the north-west corner of the park, between Gardiner's River and the West Gallatin River. The outlying spurs are cut and worn into most peculiar forms by glacial action. The survey of this area, comprising about four hundred square miles, occupied nearly a month, on account of the rugged character of the country and the detail with which the work was carried on. In the more level portions of the park it progressed more rapidly. Three hundred square miles of the plateau region lying more to the southward were surveyed during the latter part of the month. In September the work was extended still farther to the southward, until the heavy snows early in October compelled the postponement of further work to another season. The entire area surveyed in detail during the season is outlined as follows: on the north and west the limits are the boundaries of the park in those directions; on the east it is bounded approximately by the Norris wagon-road and Gardiner's River; and on the south by the lower geyser basin and the Fire Hole River. Besides the detailed work thus defined, meanders were run, and preliminary work extended, over all the usually travelled routes.

Upon the return of the party to Bozeman in October, a remeasurement, with compensated bars, was made of the base-line at that place, laid out in 1877 by the 'Geographical surveys west of the 100th meridian.' In this work Mr. Renshawe was rendered efficient service by Messrs. Chase and Garrett of the U. S. navy. The former is now at work on the computation and adjustment of these measurements.

Potsdam fauna at Saratoga, N.Y. — Mr. C. D. Walcott is closing up his work on the paleontology of the Eureka district, and preparing to take up the Potsdam fauna of the United States. From the past season's field-work, it was discovered that a massive

limestone, containing a typical Potsdam fauna, overlies the Potsdam sandstone of the New-York geologists in Saratoga county, N.Y. This limestone rests above the sandstone of Keesville, Whitehall, and Corrinth, and is shown to be the true representative of the Potsdam sandstone of Wisconsin, as it contains Lingula accuminata, Platyceras minutissima, Metoptoma cornutiforme, Crepicephalus sp.?., Lonchocephalus calciferous, Dicellocephalus Harti, and Ptychaspis speciosus, — species all closely allied to those from Wisconsin. This limestone was referred to the calciferous formation originally; the great Stromatopora-like bodies of Hoyt's quarry, four miles west of Saratoga, occurring in it.

The contained fauna was partially described by Mr. Walcott in the thirty-second annual report of the New-York state museum of natural history, and referred to the calciferous formation.

The U. S. naval observatory.

Chronometers. — This department of the observatory is in charge of Lieut. E. K. Moore, assisted by Lieuts. E. C. Pendleton and U. R. Harris. There are at present in the chronometer-room 233 chronometers, of which 22 are ready for issue; 21 are on trial; 71 require repairs, and will be repaired as wanted for issue; and 119 are condemned to be used only as 'hacks.' A temperature-room has been constructed for the more perfect testing of chronometers, and the observatory is now prepared to test them at any temperature to which they will be subjected in their practical uses. A proposition was made to the chronometer-makers, each to place four chronometers at the observatory for a competitive trial, beginning Jan. 1, 1884, the bureau of navigation to purchase the four passing the best trials. This has been accepted by William Bond & Son, Boston, T. S. & J. D. Negus, John Bliss & Co., and D. Eggert's Sons, of New York. By this method of purchasing, the best American made chronometers will be obtained.

Transmission of time-signals. — This work is in charge of the officers having the care of the chronometers. The time continues to be sent over the wires of the Western union telegraph company, and time-balls to be dropped at New York and Washington, as stated in last report. This work is all done automatically by direct connection with the observatory clock. The fire-alarm bells continue to be struck, and the time to be given to the horological establishments of the city at six A.M., twelve M., and six P.M.

Nautical instruments. — This work is in charge of Lieut. W. E. Sewell. 121 sextants and octants have been received at the observatory for examination. 46 of this number have been found in good order. There are remaining on hand at the observatory 77 instruments, 10 of which may be made serviceable by repairs: the remainder have serious defects, which will render most of them worthless. The principal of these defects are bent arcs or bent pivots. Another very common defect is want of parallelism in the glasses. Few of the makers seem to have exercised much care in this respect. The sextants and octants made by Stackpole & Brother of New York are superior to all others. The shades of 5 artificial horizons have been tested for parallelism of the glasses; and 3 were found defective, changing the direction of the rays from 1′ to 2′.5. Two standard thermometers, made for the observatory by J. & H. J. Green of New York, have been tested for their freezing and boiling points, and their tubes calibrated. At no point was the error found to be greater than a fifteenth of a degree. Tables of corrections for 45 clinical thermometers have been made for the marine hospital service.

The library. — The library now contains nearly twelve thousand volumes. The accessions for the year aggregate sixteen hundred and two volumes, besides a large number of pamphlets. The annual volume of astronomical and meteorological observations for 1879 has been recently received from the public printer, and the copies are now being sent out. The demand for the volumes is very great, there being six hundred addresses on the regular list. The manuscript, consisting of eight hundred and seventy-five pages, for a complete catalogue of the books and pamphlets in the library, July 1, 1883, alphabetically arranged by authors and subjects, is now ready for printing.

Publications. — The printing of the volume for 1880 is nearly finished, while the manuscript for the volume for 1881 is nearly ready for the printer. The printing of the annual volume is falling behind from year to year; and, with the apparently necessary expenditure of the printing-fund at the disposal of the navy department, this seems inevitable. The department fund is ususally exhausted by the last of April, and then two months' time is lost. If there were a fund at the sole disposal of the observatory, this difficulty could be overcome. The superintendent therefore urges that Congress be asked to appropriate seven thousand dollars annually for printing the observatory volumes, until the back work can be brought up as near as practicable to date.

U. S. astronomical expedition to Chile. — Professor William Harkness, assisted by Mr. Emil Wiessner, has made progress in reducing the zone observations made in Chile during the years 1850, 1851, 1852, by the expedition under the late Capt. J. M. Gilliss, U.S.N. The total number of stars is about seventeen thousand. On June 30, 1883, the appropriation from which Mr. Wiessner was paid became exhausted, and the work ceased. About a thousand dollars are needed to finish the preparation of the star catalogue from these zones, and it is hoped that Congress will grant that sum at the next session.

Increased estimates have been submitted for the coming year. The reasons for such increase are explained in each case in the letter accompanying the estimates. Experience suggests that the efficiency of the observatory should be increased by the appointment of a board of visitors, to consist of a limited number of distinguished astronomers, whose duty it would be annually to examine into the working of the observatory, and report to the secretary of the navy. They should have power to advise with the superintendent as to the character of the work to be done at the observatory.